

WHAT IS CLAIMED IS:

1.           An ultrasonic array sensor comprising:  
              a transmitter element array in which a plurality of transmitter elements for transmitting ultrasonic waves are arrayed; and  
              a receiver element array in which a plurality of receiver elements for receiving ultrasonic waves are arrayed;  
              wherein said elements of said element arrays are arrayed so that each of said elements is 0.1 mm to 2 mm wide and adjacent ones of said elements in each of said element arrays are at a distance of 0.05 mm to 0.2 mm from each other.
2.           An ultrasonic array sensor according to Claim 1, wherein said elements of said element arrays are arrayed in a range surrounded by 30 mm width of said array sensor in an array direction of said elements and 30 mm depth of said array sensor in a length direction of said elements perpendicular to said array direction.
3.           An ultrasonic array sensor according to Claim 1, wherein said transmitter elements and said receiver elements are disposed alternately.
4.           An ultrasonic array sensor according to Claim 1, wherein an entrance/exit surface of ultrasonic waves has a surface shape formed into a part of a cylindrical shape or a spherical shape.
5.           An ultrasonic inspection instrument comprising:

an array sensor having both a transmitter element array in which a plurality of transmitter elements for transmitting ultrasonic waves are arrayed and a receiver element array in which a plurality of receiver elements for receiving ultrasonic waves are arrayed;

a control unit for focusing ultrasonic waves transmitted from said transmitter elements respectively on a focus point where half the sum of a transmitting angle and a receiving angle will be not larger than 30 degrees;

a generation unit for generating inspection information based on said ultrasonic waves received by said receiver elements; and

a display unit for displaying said inspection information generated by said generation unit.

6. An ultrasonic inspection instrument according to Claim 5, further comprising a control unit for moving said focus point electronically to a range including said position where half the sum of a transmitting angle and a receiving angle will be not larger than 30 degrees.

7. An ultrasonic inspection instrument according to Claim 5, wherein said array sensor is an array sensor according to any one of Claims 1 to 4.

8. An ultrasonic inspection instrument according to Claim 5, further comprising a first amplification control unit for changing amplification of a signal to

be supplied to each of said transmitter elements in accordance with said focus point.

9. An ultrasonic inspection instrument according to Claim 5, further comprising a second amplification control unit for changing amplification of a signal to be supplied from each of said receiver elements in accordance with said focus point.

10. An ultrasonic inspection instrument according to Claim 5, wherein said array sensor is attached to a handling pole.

11. An ultrasonic inspection instrument according to Claim 5, further comprising:

a mast supported by a core plate and a top guide in a nuclear reactor; and

an extensible/retractable link mechanism attached to said mast;

wherein said array sensor is attached to said link mechanism.

12. An ultrasonic inspection instrument according to Claim 5, further comprising:

a mast supported by a core plate and a top guide in a nuclear reactor; and

an articulated manipulator attached to said mast;

wherein said array sensor is attached to said articulated manipulator.

13. An ultrasonic inspection instrument according to Claim 5, further comprising:

an inspection unit having an illuminator for illuminating a subject to be inspected, imaging device for imaging said subject to be inspected, a unit for removing crud from said subject to be inspected, said removing unit for sucking and collecting said crud, and an underwater thruster;

wherein said array sensor is attached to said inspection unit.

14. An ultrasonic inspection method for controlling an ultrasonic inspection instrument comprising the steps of:

transmitting and receiving ultrasonic waves to and from a subject to be inspected, by means of an array sensor having both a transmitter element array in which a plurality of transmitter elements for transmitting ultrasonic waves are arrayed and a receiver element array in which a plurality of receiver elements for receiving ultrasonic waves are arrayed; and

focusing said ultrasonic waves on a focus point where half the sum of a transmitting angle and a receiving angle involved in said transmission and reception is not larger than 30 degrees.

15. An ultrasonic inspection method according to Claim 14, wherein an array sensor according to any one of Claims 1 to 4 is used as said array sensor.

16. An ultrasonic inspection method according to Claim 14, wherein a central portion of said array

sensor is aligned with a position opposed to an opening portion of a near surface crack of said subject to be inspected, and said ultrasonic waves are thereafter transmitted to and received from said subject to be inspected whenever a focus point of said ultrasonic waves is moved for electronically scanning said subject to be inspected.

17. An ultrasonic inspection method according to Claim 16, wherein amplification of a signal to be supplied to each of said transmitter elements or a signal to be supplied from each of said receiver elements is increased with increase of a distance between said focus point and said array sensor.

18. An ultrasonic inspection method according to Claim 14, wherein said array sensor is attached to a handling pole, an articulated manipulator, a link mechanism or an underwater inspection unit, and said handling pole, said articulated manipulator, said link mechanism or said underwater inspection unit is operated to move said array sensor to an inspection position of said subject to be inspected.

19. An ultrasonic inspection method according to Claim 14, wherein an array sensor having a foot print on said subject to be inspected is used as said array sensor, said foot print being equal to or smaller than width of said subject to be inspected.

20. An ultrasonic inspection instrument comprising:

an array sensor having both a transmitter element array in which a plurality of transmitter elements for transmitting ultrasonic waves are arrayed and a receiver element array in which a plurality of receiver elements for receiving ultrasonic waves are arrayed;

a control unit for focusing ultrasonic waves transmitted from said transmitter elements on a focus point;

an amplification control unit for changing amplification of at least one of a signal to be supplied to each of said transmitter elements and a signal to be supplied from each of said receiver elements, in accordance with said focus point;

a generation unit for generating inspection information based on said ultrasonic waves received by said receiver elements; and

a display unit for displaying said inspection information generated by said generation unit.